At str July 26

Tuesday, July 26, 2022 6:13 PM

$\lambda = \frac{h}{\sqrt{2mqV}}$

(i) If particle is electron

$$\lambda_e = \frac{h}{\sqrt{2m_e eV}} = \frac{12.27}{\sqrt{V}} A^\circ$$

$1 nm = 10 A^\circ$

(ii) If particle is α-particle (He^{2+})

$$\lambda_\alpha = \frac{h}{\sqrt{2m_\alpha q_\alpha V}} = \frac{0.101}{\sqrt{V}} A^\circ$$

$m_\alpha = 4 amu = 4 \times 1.66 \times 10^{-24} g$

$q_\alpha = 2e = 2 \times 1.6 \times 10^{-19} C$

$h = 6.63 \times 10^{-34} J.s$

Q→ If $\bar{e}$ is accelerated in potential Difference of 3 Volts. find de-Broglie Wavelength of $\bar{e}$ in nm?

Solⁿ ⇒ $\lambda_e = \frac{12.27}{\sqrt{V}} A^\circ$

$\lambda_e = \frac{1.227}{\sqrt{V}} nm$

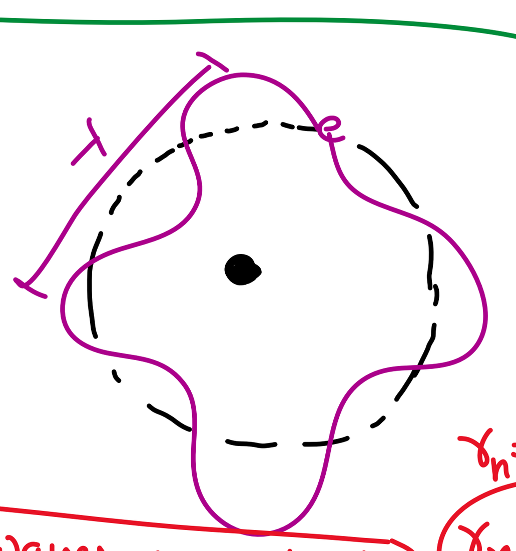
$= \frac{1.227}{\sqrt{3}}$

$= \frac{1.227}{1.732} \approx \frac{1.2}{1.8}$

$= 0.66$

≈ 0.69

#



$\boxed{2\pi r_n = n\lambda_e}$

No. of waves or wavelength formed by $\bar{e}$ in any orbit = orbit No.

$r_n = 0.529 \frac{n^2}{Z} A^\circ$

$r_n = a_0 \frac{n^2}{Z}$

$m_e v_n r_n = \frac{nh}{2\pi}$

$2\pi r_n = n \frac{h}{m_e v_n}$

$\boxed{2\pi r_n = n\lambda}$

Q→ If radius of 3^{rd} orbit of H is x pm. find de-broglie Wavelength of $\bar{e}$ in Ist excited state of He^+? (Answer shud be in terms of x)

n=2

Solⁿ ⇒ $r_3(H) = a_0 \frac{(3)^2}{1} = x$

$a_0 = \frac{x}{9}$

$2\pi r_2(He^+) = 2\lambda$

$2\pi \left[a_0 \frac{(2)^2}{2}\right] = 2\lambda$

$2\pi \times \frac{x}{9} \times \cancel{2} = \cancel{2}\lambda$

$\lambda = \frac{2\pi x}{9}$ pm

Q→ Radius of Ist excited state of Be^{3+} is y nm. find λ of $\bar{e}$ in 2^{nd} excited state of Li^{2+}?

Solⁿ → $r_2(Be^{3+}) = a_0 \times \frac{2^2}{4} = a_0 = y$

$2\pi r_3(Li^{2+}) = 3\lambda$

$2\pi \left(a_0 \frac{(3)^2}{3}\right) = 3\lambda$

$\lambda = 2\pi y$ ✓

H.W ⇒ Pg-51 (Q→53)

→ Pg-63 (Q-7, 8, 5, 6)

→ Pg-62 (Q-3)

→ Q→1 (Sec F, Pg-67)

Q-2

Q-3

Q-5

→ Q→3 (Pg-70)

Comprehension-I

→ Pg-64

HUP (Heisenberg's uncertainity Principle)

It is impossible to determine exact position and momentum (or velocity) simultaneously for microscopic particles (like $\bar{e}$, p, n, atom, ion etc)

$$\boxed{\Delta x \times \Delta p \geq \frac{h}{4\pi} \text{ or } \frac{\hbar}{2}}$$

$\hbar = \frac{h}{2\pi}$

Δx = uncertainity in position of particle

Δp = uncertainity in momentum of particle

$\Delta x \times m\Delta v \geq \frac{h}{4\pi}$

$$\boxed{\Delta x \times \Delta v \geq \frac{h}{4\pi m}}$$

** $\Delta\theta \times \Delta\phi \geq \frac{h}{4\pi}$

Δθ = uncertainity in angular momentum

Δφ = uncertainity in angular position

Q→ An electron near an atomic nucleus has a velocity $5 \times 10^6 \pm 2\%$ (m/s). what is uncertainity in its position?

Solⁿ → $\Delta v = 2\%$ of 5×10^6

$= \frac{2}{100} \times 5 \times 10^6$

$= 10^5 m/s$

$\Delta x = \frac{h}{4\pi m \Delta v} = \frac{\frac{1}{2} \times 10^{-34}}{9.1 \times 10^{-31} \times 10^5} m$

$\frac{h}{4\pi} = \frac{6.63 \times 10^{-34} J.s}{4 \times 3.14}$

$\approx \frac{1}{2} \times 10^{-34}$

Pg-23

Q→19) $\bar{e}$ moving with 600 m/s with an accuracy of 0.005%. Certainity with which electron can be located?

$600 \pm 0.005\%$

Solⁿ $\Delta v = 600 \times \frac{0.005}{100} m/s$

$\Delta x = \frac{h}{4\pi m_e \Delta v}$

H.W

Q→20 (Pg-23)

Q→ min de-Broglie wavelength? (All are moving with same velocity)

1) $\bar{e}$ 2) proton 3) α-particle 4) NO_2 molecule ✓

$\Delta x \times \Delta p \geq \frac{h}{4\pi}$

If position is exact, → $\Delta x = 0$

$\Delta p = \frac{h}{4\pi \times 0} \to \infty$